**(AP) ENVIRONMENTAL SCIENCE 2022-23 September 28, 2022**

**Today’s Agenda (Day 30)**

1. Housekeeping Items

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1. Homework Check:

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1. Class Activity:

🡪DAY 1: Chapter 4 PPT Review

1. **Section 4.1 – The Nature of Science**
2. **Section 4.2 - Limitations of Science**
3. Section 4.3 – Pseudoscience
4. Section 4.4 – The Structure of Matter
5. Section 4.5 – Energy Principles
6. Section 4.6 – Environmental Implications of Energy Flow

HOMEWORK:

* READ: Chapter 3 – Risk, Economics, and Environmental Concerns
* COMPLETE: Lab – Happy Fishing, Ch 4 Reading Guide
* **STUDY**: Ch 3 & 4 Vocabulary, Chapter 4 Test

CHAPTER 3 VOCABULARY

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Cost-benefit analysis | Deferred costs | Demand | Economics | Ecosystem services | environmental costs |
| Extended product responsibility | External costs | Life cycle analysis | Natural resources | negligible risk | Nonrenewable resources |
| Opportunity costs | Pollution | Pollution costs | pollution prevention | price probability | Renewable resources |
| Resources | Risk | risk assessment | risk management | Subsidy | Supply |
| supply/demand curve | sustainable development |  |  |  |  |

CHAPTER 4 – Matter, Energy and Environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Acid | Activation energy | Atoms | Base | Catalyst | Cause and effect relationships |
| Chemical bonds | Combustion | Compound | Controlled experiment | Electrons | Elements |
| Endothermic reactions | Energy | Entropy | Enzymes | Exothermic reactions | Experiment |
| First law of thermodynamics | Hydroxide ions | Hypothesis | Ions | Isotopes | Kinetic energy |
| Kinetic molecular theory | Latent heat | Law of conservation of mass | Matter | Mixtures | Molecules |
| Neutrons | Nucleus | Observation | pH | Photosynthesis | Potential energy |
| Protons | Pseudoscience | Reproducibility | Respiration | Science | Scientific law |
| Scientific method | Second law of thermodynamics | Sensible heat | Theory | Variables |  |

REMINDERS

* **QUIZ: Ch 3 & 4 Vocabulary** 🡪 **Sept. 29**
* LAB: Happy Fishing – Sept. 29
* Chapter 4 Reading Guide – Oct. 11
* **TEST:** **Ch 4 🡪 ~~Sept. 29~~ Oct. 13**

**(AP) ENVIRONMENTAL SCIENCE 2022-23 READING GUIDE**

**CHAPTER 4**

REVIEW QUESTIONS

1. How do scientific disciplines differ from nonscientific disciplines?

2. What is a hypothesis? Why is it an important part of the way scientists think?

3. Why are events that happen only once difficult to analyze from a scientific point of view?

4. What is the scientific method, and what processes does it involve?

5. How are the second law of thermodynamics and pollution related?

6. Diagram an atom of oxygen and label its parts.

7. What happens to atoms during a chemical reaction?

8. State the first and second laws of thermodynamics.

9. How do solids, liquids, and gases differ from one another at the molecular level?

10. List five kinds of energy.

11. Are all kinds of energy equal in their capacity to bring about changes? Why or why not?

CRITICAL THINKING QUESTIONS [for APES students only]

1. You observe that a high percentage of frogs, which are especially sensitive to environmental poisons, in small ponds in your agricultural region have birth defects. Suspecting agricultural chemicals present in runoff to be the culprit, state the hypothesis in your own words. Next, devise an experiment that might help you support or reject your hypothesis.

2. Given the experiment you proposed in Critical Thinking Question 1, imagine some results that would support that hypothesis. Now imagine you are a different scientist, one who is very skeptical of the initial hypothesis. How convincing do you find these data? What other possible explanations (hypotheses) might there be to explain the results? Devise a different experiment to test this new hypothesis.

3. Increasingly, environmental issues such as global climate change are moving to the forefront of world concern. What role should science play in public policy decisions? How should we decide between competing scientific explanations about an environmental concern such as global climate change? What might be some of the criteria for deciding what is “good science” and what is “bad science”?

4. How important are the first and second laws of thermodynamics to explaining environmental issues? Using the concepts in these laws of thermodynamics, try to explain a particular environmental issue. How does an understanding of thermodynamics change your conceptual framework regarding this issue?

5. The text points out that incandescent lightbulbs are only 5–10 percent efficient at using energy to accomplish their task, while new, initially more expensive, compact fluorescent lighting uses significantly less electricity to provide the same quantity of light. Examine the contextual framework of those who advocate for new lighting methods and the contextual framework of those who continue to design and build using the old methods. What are the major differences in perspective? What could you suggest being done to help bring these different perspectives closer together?

6. Some scientists argue that living organisms constantly battle against the principles of the second law of thermodynamics using the principles of the first law of thermodynamics. What might they mean by this? Do you think this is accurate? What might be some of the implications of this for living organisms?

**(AP) ENVIRONMENTAL SCIENCE 2022-23 LAB ACTIVITY**

**Happy Fishing Game**

A picture containing diagram

Description automatically generated

**Background Information:**   In 1968, a scientist by the name of Dr. Garrett Harden coined the concept called the “***Tragedy of the Commons***”.  *“The Tragedy of the Commons”* is a problem that occurs when a resource –*such as the ocean, water, and air*- is open to everyone. Overtime, these resources become *overexploited,* and the consumers face the choice of restricting their own *consumption* for the good of the resource and community or continuing to consume/use the resource opting to face dire consequences at a later time. When people are not compelled to preserve resources for the welfare of future generations, the *Tragedy of the Commons* occurs.

**Lab Objective:**  Students will participate in an activity that will help them better understand the concept of the “***Tragedy of the Commons***” and the difficulties associated with managing these shared resources.

**Preparation:** Divide students into groups of 4 participants. Each group should sit around the "lake” *(common resource).*

**Materials:**

* **Goldfish- Colored**
* **Bowl *(Lake)***
* **Straws *(at least 1 per student)***
* **Plastic spoons *(at least 1 per student)***

**Scenario:** Each one of you represents the head of a family ***(fisherman)*** where the only source of income is to sell your daily fish catch. In order for your family to survive, you must catch enough fishto pay your ***operating costs*** and make profit to pay for your ***living expenses***\*. The only food source is a small local lake, which can accommodate up to **16** fish. You must catch the fish by sucking up the "fish" from the lake with straws ***(fishing pole)*** or using a spoon to scoop up the fish ***(net).*** Each student will get a chance to fish once a year ***(which lasts 30 seconds)*** and each time you fish you may take 0, 1, 2, 3 or 4 fish from the lake. **“It is your choice of how many fish (0-4) you take, however, if you only take one fish, you will not make enough to support your family and pay for your fishing expenses.”** Each fish has a different “redemption value” based on color. After the annual fishing season has ended, any remaining fish will reproduce **once** during the off-season- each remaining fish is able to reproduce and make one new fish ***(based on color- a maximum of 4 each- total of 16).***  If you are unable to catch enough fish to support your fishing activity your game is over. **The student with the most “money” at the end will win a prize.**

**Activity Procedures:**

1. Each student will start with **$25** in ocean currency
2. Students are given the option of fishing gear:
   1. **Fishing pole (straw)** – cost $1 **one-time fee**
   2. **Fishing net (spoon)** – cost $5 **annual fee**
3. Students will get 30 seconds to fish.  **Remember, you must catch enough to support your family and pay your annual expenses** *(at least $20 per year).*
4. At the end of each year *(round)*, the teacher will add an additional goldfish for each fish remaining in the lake. Make sure to add according to the colors remaining.  **Each fish can replicate x 1 each *(for a maximum of 16 in bowl).***
5. At the end of the first fishing season, fill in your worksheet. If you are unable to cover your annual expenses, you are unable to fish the next year. ***You have gone bankrupt and must sit out of the game.***
6. If your group still has fish remaining in the lake, continue to run another annual fishing season ***(Year 2a).***
7. Repeat steps 2 – 5. *Again, if you are unable to cover your annual expenses, you are unable to fish the next year.*
8. Once the fish are exhausted - total up your worksheet.

**Student Rules**

1. **NO TALKING DURING ACTIVITY**
2. Fisherman can only “fish” ***one fish at a time.***
3. *No “hitting” or ‘knocking” other fisherman- will result in a fine (see teacher for details)*

12. Keep all catch fish in front of you- *for teacher to count after round*

13. If you are out of fish or out of money- *you will have to sit out!*

14. **There is a PRIZE for the player that has the most money at the end of the game!!**

**Happy Fishing Budget Sheet** [Refer to Live Spreadsheet Template]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **HAPPY FISHING BUDGET SHEET** |  |  |  |  |
|  |  |  |  |  |
| **Fisherman Name:** |  |  |  |  |
|  |  |  |  |  |
| **Year 1 - Operating Costs/Profits** |  | **Starting Amount:** | $25.00 |  |
| Annual Fishing Fees |  |  | *minus* |  |
| \*Fishing Permit - $5 per year |  |  |  |  |
| \*Boat Maintenance/Fuel/Slip Fees - $5 per year |  |  |  |  |
| \*Cost of Living (rent, food, etc) - $10 per year |  |  |  |  |
| SUBTOTAL: |  |  | **$0.00** |  |
| OPTION: Choose which type of fishing equipment you will use |  |  |  |  |
| \*Fishing Pole (straw) - $1 initial fee **(no annual charges)** |  |  |  |  |
| \*Large Fishing Nets (spoon) $5 **annual fee** |  |  |  |  |
| SUBTOTAL: |  |  | **$0.00** |  |
| **TOTAL OPERATING COSTS (Year 1)** |  |  | **$0.00** |  |
| **\*\*Need at LEAST $20 worth of fish each year to survive\*\*** |  |  |  |  |
|  |  |  |  |  |
| **Year 1 - Fishing Profits** |  |  |  |  |
| \*Goldfish - $5 each | x |  | **$0.00** |  |
| \*Greenfish - $6 each | x |  | **$0.00** |  |
| \*Redfish - $8 each | x |  | **$0.00** |  |
| \*Bluefish - 12 each | x |  | **$0.00** |  |
| **TOTAL PROFITS** |  |  | **$0.00** |  |
|  |  |  |  |  |
| **NET Total for YEAR 1** |  |  | **$25.00** |  |
|  |  |  |  |  |
| QUESTION: Did you make a profit? Did you go bankrupt" |  |  |  |  |
|  |  |  |  |  |
| **Year 2 - Operating Costs/Profits** |  | **Starting Amount:** |  |  |
| Annual Fishing Fees |  |  |  |  |
| \*Fishing Permit - $5 per year |  |  |  |  |
| \*Boat Maintenance/Fuel/Slip Fees - $5 per year |  |  |  |  |
| \*Cost of Living (rent, food, etx) - $10 per year |  |  |  |  |
| SUBTOTAL: |  |  | **$0.00** |  |
| *You would need to pay another fee if you choose to use the nets!!* |  |  |  |  |
| \*Large Fishing Nets (spoon) $5 **annual fee** |  |  |  |  |
| **TOTAL OPERATING COSTS (Year 2)** |  |  | **$0.00** |  |
|  |  |  |  |  |
| **Year 2 - Fishing Profits** |  |  |  |  |
| \*Goldfish - $5 each | x |  | **$0.00** |  |
| \*Greenfish - $6 each | x |  | **$0.00** |  |
| \*Redfish - $8 each | x |  | **$0.00** |  |
| \*Bluefish - 12 each | x |  | **$0.00** |  |
| **TOTAL PROFITS** |  |  | **$0.00** |  |
|  |  |  |  |  |
| **NET Total for YEAR 2** |  |  | **$0.00** |  |
|  |  |  |  |  |
| QUESTION: Did you make a profit? Did you go bankrupt" |  |  |  |  |
|  |  |  |  |  |

Happy Fishing Lab- Tragedy of the Commons

**Discussion Questions**

1.   Did anyone in your group take too many fish?  How did that make you feel?  Did everyone try to take as many as possible?  Why or why not?  ***Does society reward those with the “most”?***

2.   Did anyone sacrifice the # of fish, *for the good of the community*?  ***Why or why not?  Does society ever reward that type of person?***

3. In Game two... **how** did your strategy change, if at all?  ***Does it make a difference to know what the rewards are?***

4.   Is it possible to maximize the number of fish caught/person **AND** the number of fish remaining in the pond **at the same time**? ***Why or why not?***

5.  Think of a **local commons** that you are familiar with. ***[parking lots, bathrooms, bookstalls, etc.]*** Do similar situations arise? **Explain. HOW might those problems be solved?**

6. What are some **natural resources** that are **common** resources?

7.  What are the **global commons**?  Are these being used wisely?  ***Why or why not?***

8. ***What can people do to use these resources most wisely?***

9. Did a particular “type” of fish disappear faster than others? ***How does this relate to “economically valuable” species in nature and their extinction rates?***

**Post-Lab:**

***Briefly summarize*** the results of this simulation and discuss the implications of this simulation on the management of common resources in the environment. ***What were the main ideas of the simulation- what did you learn?*** In your summary, please ***discuss relationships between human societies and the environment*** as well as ***possible methods to remediate overuse*** through cooperation. *What other resource management examples can you think of where this topic is relevant? What would you suggest in these situations?*